

CLAIMS:

1. An implantable marker for percutaneously implanting within a bone, the implantable marker comprising:
 - a housing having an inner cavity, the housing having an outer surface, the outer surface providing a bone anchor which engages at least partially with surrounding bone when implanted in use to retain the implantable marker in the bone; and
 - a marker secured within the cavity, wherein the marker is detectable by a tracking system.
2. An implantable marker as claimed in claim 1, wherein the marker and cavity are configured such that at least a part of the marker is positioned within the bone in use.
3. An implantable marker as claimed in claim 1 or 2, wherein the marker is hermetically sealed.
4. An implantable marker as claimed in any preceding claim 1, wherein the bone anchor is in the form of a retaining formation.
5. An implantable marker as claimed in any preceding claim, wherein the bone anchor is provided by a surface adapted to encourage bone ingrowth.
6. An implantable marker as claimed in any preceding, wherein the marker is enclosed by the housing.
7. An implantable marker as claimed in any preceding claim, wherein the marker is wirelessly detectable.
8. An implantable marker as claimed in claim 7, wherein the marker is wirelessly detectable using electromagnetic radiation within the radio frequency part of the electromagnetic spectrum.

9. An implantable marker as claimed in claim 4, wherein the retaining formation includes at least a first barb.
10. An implantable marker as claimed in claim 4, wherein the retaining formation includes a thread.
11. An implantable marker as claimed in any preceding claim, wherein the housing has an insertion end which is tapered.
12. An implantable marker as claimed in claim 11, wherein the insertion end is bone penetrating such that the implantable marker can be pushed into the bone when a force is applied to the implantable marker.
13. An implantable marker as claimed in a claim 11, wherein the insertion end includes a self tapping screw thread.
14. An implantable marker as claimed in any of claims 11, 12 or 13 wherein the insertion end includes a trochar tip.
14. An implantable marker as claimed in any preceding claim, wherein the housing has a connector for releasably engaging with an insertion tool.
15. An implantable marker as claimed in claim 13, wherein the connector is configured to prevent relative rotation between the implantable marker and an insertion tool, when connected to the insertion tool.
16. An implantable marker as claimed in claim 10, wherein at least a first portion of the thread has a cross section shaped to enhance retention of the implantable marker in the bone.
17. An implantable marker as claimed in claim 16, wherein at least a second portion of the thread has a cross section shaped to enhance cutting into the bone.

18. An implantable marker as claimed in claim 17, wherein the cross section of the second portion of the thread has a sharper profile than the cross section of the portion of the thread.

19. An implantable marker as claimed in claim 16, 17 or 18, wherein the first portion of the thread has a cross section in the shape of a rounded trapezium.

20. A kit for percutaneously implanting an Implantable marker in a bone, the kit comprising:

a guide instrument having a guide channel extending at least partially along a longitudinal axis thereof and for receiving an implantable marker therein;

an insertion tool receivable within the channel of the guide and translatable at least partially along the longitudinal axis, the insertion tool having a distal end for releasably engaging an implantable marker; and

an implantable marker receivable within the channel, the implantable marker comprising a housing defining a cavity and a marker detectable by a tracking system in the cavity, wherein the insertion tool is operable to drive the implantable marker into the bone.

21. A kit as claimed in claim 20, wherein the insertion tool has an elongate body which includes a channel extending at least partially along the longitudinal axis of the elongate body for receiving a thread attached to the implantable marker.

22. A kit as claimed in claim 21, wherein the insertion tool has an aperture for receiving the thread therethrough.

23. A kit as claimed in claim 20, wherein the implantable marker has a distal end bearing a bone penetrating tip.

24. A kit as claimed in claim 20, wherein a distal end of the guide instrument has a bone engaging formation which includes a plurality of bone penetrating teeth and wherein at least a first and a second of the plurality of bone penetrating teeth face in opposite

senses.

25. A kit as claimed in claim 20, wherein the guide instrument includes a magazine for storing a plurality of implantable markers.

26. A kit as claimed in claim 25, wherein the magazine includes a dispensing mechanism configured to automatically insert a further implantable marker into the guide channel after a current implantable marker has been implanted.

27. A kit as claimed in any of claims 20 to 26 and further comprising a drill receivable within the guide channel and translatable at least partially along the guide channel, the drill having a drill bit at a distal end for creating a hole in the bone.

28. A kit as claimed in any of claims 20 to 27, wherein when the kit is assembled into an assembly, the assembly includes a skin piercing tip extending from a distal end of the guide instrument, so that the assembly can puncture the skin of a subject.

29. A kit as claimed in claim 28, wherein the skin piercing tip is a Trochar tip.

30. A kit as claimed in claim 28 or 29, wherein the implantable marker has the skin piercing tip, such that when the kit is assembled into the assembly the implantable marker is located within the guide channel with the skin piercing tip extending from the distal end of the guide instrument.

31. A kit as claimed in claim 28 or 29, wherein the kit includes a drill locatable within the guide channel and having a drill bit, wherein the drill bit has the skin piercing tip, such that when the kit is assembled into the assembly the drill is located within the guide channel with the skin piercing tip extending from the distal end of the guide instrument.

32. A kit as claimed in claim 27, wherein the insertion tool includes the drill and wherein the distal end of the insertion tool is a separable part of the insertion tool into which at least the drill bit can be releasably fastened to provide the insertion tool.

33. A method for percutaneously implanting an implantable marker in a bone, wherein the marker is detectable by a tracking system, the method comprising:
puncturing the skin with an instrument and positioning a distal end of the instrument adjacent the bone;
driving the implantable marker into the bone from the instrument; and
withdrawing the instrument while leaving the marker implanted within the bone.
34. The method of claim 33, wherein driving the implantable marker into the bone further comprises pushing the implantable marker into the bone.
35. The method of claim 33 or 34, wherein driving the implantable marker into the bone further comprises screwing the implantable marker into the bone.
36. The method of any of claims 33 to 35, and further comprising drilling a hole in the bone before driving the implantable marker into the bone, and wherein the implantable marker is driven into the hole.
37. The method of claim 36, wherein the instrument includes a guide channel extending at least partially along a longitudinal axis of the instrument, and drilling the hole includes translating a drill at least partially along the guide channel of the instrument.
38. The method of claim 33, wherein the implantable marker has a skin piercing tip and puncturing the skin includes using the skin piercing tip of the implantable marker to puncture the skin.
39. The method of claim 33, wherein the instrument includes a guide channel and a drill located within the guide channel, the drill having a skin piercing tip, and wherein puncturing the skin includes using the skin piercing tip of the drill to puncture the skin.
40. The method as claimed in claim 33, wherein the implantable marker has a thread attached to it and the thread has a free end, the method further comprising leaving the free

end of the thread outside the skin.

41. The method as claimed in claim 40, and further comprising using the thread to percutaneously guide a tool to engage with a free end of the implantable marker.

42. The method as claimed in claim 41, and further comprising using the tool to disengage the implantable marker from the bone and percutaneously withdrawing the marker from the bone so as to remove the implantable marker from the patient.

43. A method for tracking the position of a body part, comprising:
percutaneously implanting an implantable marker in a bone using the method of any of claims 33 to 41; and
tracking the position of the implantable marker using a tracking system.

44. A method as claimed in claim 43, wherein the position of the implantable marker is tracked wirelessly.

45. A method as claimed in claim 44, wherein the implantable marker is tracked wirelessly using electromagnetic signals within the radio frequency part of the electromagnetic spectrum.

46. A method for carrying out a computer aided or image guided surgical, prophylactic, medical or clinical procedure on a subject, comprising:
carrying out a surgical, prophylactic, medical or clinical procedure; and
tracking the position of a body part of the subject during the surgical, prophylactic, medical or clinical procedure using the method as claimed in any of claims 43 to 45.

47. An implantable marker for percutaneously implanting within a bone, the implantable marker comprising:
a housing having a body section, a distal end and a proximal end, wherein the body section is cylindrical and defines a cavity therein, the distal end is tapered, the

proximal end has a connector for engaging an insertion tool, and wherein the housing has an outer surface bearing a screw thread; and

a marker enclosed within the cavity, the marker being hermetically sealed and wirelessly detectable by a tracking system using electromagnetic radiation within the radio frequency part of the electromagnetic spectrum, and wherein the implantable marker is retained in the bone in use by the interaction of the screw thread and surrounding bone and wherein the marker and cavity are configured such that the marker is located within the surrounding bone when the implantable marker is implanted in the bone in use.

48. An implantable marker as claimed in any fo claims 1 to 19 or 47, and further comprising a transducer or sensor for detecting a property in the region around the marker.

49. An implantable marker as claimed in claim 48, wherein the sensor or transducer is sensitive to a property selected from the group comprising: pressure; temperature; biological activity; and chemical.